

The University of Michigan • Office of Research Administration
Ann Arbor, Michigan

pl
May, 1965.

National Aeronautics and Space Administration
Washington 25, D.C. 20546

N65-86032

Choke Line
Use CR 63678

Attention: Office of Space Science and Applications
Grants and Research Contracts Division

SUBJECT: Status Report on NsG-124-61, RESEARCH ON HEAT-
RESISTANT ALLOYS

A status report on the subject Grant is hereby submitted covering the period from November 1, 1964 to April 30, 1965.

The primary objective of the research conducted during this time was the determination of the elevated temperature properties of Inconel 718 alloy in sheet form under conditions of stress and temperature expected to be encountered in certain sections of the supersonic transport. This research was undertaken because the anticipated severe service conditions made it unlikely that a material less refractory than a superalloy would possess adequate properties. It has already been shown in the investigation that two aluminum plus titanium strengthened superalloys, Rene' 41 and Waspaloy, did not have sufficiently promising notched specimen properties at 1000° and 1200°F to be considered as appropriate for application in the SST.

The results of tests on Inconel 718 alloy were submitted to the NASA in April in a summary report entitled "The Mechanical Properties of Inconel 718 Sheet Alloy at 800°, 1000°, and 1200°F", by T. M. Cullen and J. W. Freeman. The smooth specimen creep and rupture strengths as well as the notched specimen properties of the alloy were shown to be highly dependent upon the prior thermal treatment the alloy had received.

In specimens fully heat treated after cold working, the smooth specimen creep and rupture properties were inversely related to notched specimen properties. When smooth specimen creep resistance and rupture strengths were high the notched specimen rupture strength was low and vice versa. Even when smooth specimen properties were relatively low, however, they were sufficient to justify the use of the alloy in that condition in the SST at service temperatures as high as 1150°F. The corresponding notched specimen properties were quite high. This finding was in marked contrast to results obtained earlier in this investigation which showed that aluminum plus titanium hardened superalloys were notch sensitive in every condition of heat treatment evaluated.

Intensified work has been initiated on determining the causes of the sensitivity of aluminum plus titanium strengthened nickel-base alloys to ASTM sharp edge-notches. Since Inconel 718 can be made notch sensitive or insensitive depending upon heat treatment it is felt that the cause of the notch sensitivity can be found in the microstructure. For this reason detailed structural studies of these alloys are now in progress.